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INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for August, 1887, and is based upon reports of regular and voluntary observers of both countries. Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i, on which also appears the distribution of icebergs and field ice reported, and the limits of fog-belts to the westward of the fortieth meridian. In tracing the centres of the paths of these storms, data from the reports of two hundred and nineteen vessels have been used. The severe disturbances which attended the passage of ocean depressions numbers 5 and 8 constituted a noteworthy feature of the month. The aggregate quantity of ice encountered on the southeast edge of the Banks of Newfoundland exceeded the average amount reported for corresponding months of previous years. Fog was less frequently encountered in the trans-Atlantic routes west of the fortieth meridian than during the preceding month.

The average number of areas of low pressure for August during the last fourteen years is ten; on chart i for the present month are traced the paths of eight such areas.

The mean temperature of August over the entire country differs but slightly from the normal; in the southern districts the month was somewhat warmer than the average August, while in northern sections it was slightly cooler.

The rainfall was very heavy in portions of the south Atlantic states, but there was a general deficiency in all other districts east of the Mississippi. From the upper Missouri val-

ley westward to Washington Territory the rainfall was above the average, and below the average over the southwestern part of the country.

With this issue of the REVIEW the numbers of the charts showing precipitation and departures from normal pressure and temperature will be reversed. In future the chart showing departures from normal pressure and temperature will be designated as number iii, and the precipitation chart will be numbered iv.

In the preparation of this REVIEW the following data, received up to September 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-one Canadian stations, as telegraphed to this office; one hundred and seventy-three monthly journals and one hundred and sixty-five monthly means from the former and twenty-one monthly means from the latter; two hundred and seventy-three monthly registers from voluntary observers; fifty-nine monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" monthly weather reports from the local weather services of Arkansas, Colorado, Dakota, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Mississippi, Nebraska, New England, New Jersey, New York, North Carolina, Ohio, Oregon, South Carolina, and Tennessee; and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for August, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii. Two areas of maximum pressure, indicated by the isobar of 30.0, are shown on the chart for August; one of these areas covers the Lake region, and the other the western portion of Washington Territory. The barometric means are least over California and the southern plateau, the area of minimum pressure, indicated by the isobar of 29.75, including portions of California, Nevada, and Arizona. The regions of maximum and minimum pressure cover comparatively small areas; the pressure over nearly the whole country being evenly distributed, the means generally ranging from 29.9 to 29.95.

As compared with the mean pressure for the preceding month, an increase is shown over the northern part of the country from the Missouri Valley eastward to the New England and middle Atlantic coasts, generally ranging from .01 to .05, except over the Lake region, where it amounts to from .06 to .09. In all other portions of the country the mean pressure for August is below that for July. Along the Gulf coast, and in the Rocky Mountain region, the decrease ranges from .05 to .09, and on the Pacific coast from .09 to .11.

The departures from the normal pressure for the various stations are given in the tables of miscellaneous meteorological data; they are also graphically exhibited on chart iii (formerly chart iv) by lines connecting stations of normal or equal ab-

normal values. The mean pressure for August is below the normal throughout the United States, with the exception of the region extending along the northern border from Dakota to Lake Huron, where the mean pressure is from .01 to .05 in excess of the normal. While the mean pressure over much of the country is below the normal the deficiencies are not marked; they nowhere exceed .07, and over a large part of the country are less than .05.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous data. The ranges for August closely agree with the normal barometric ranges for this month. They are greatest in the upper Missouri valley and the eastern part of the northern slope; they are least in the southwestern part of the country from the lower Mississippi river to the Pacific coast. The following are some of the extremes:

Greatest.		Least.	
	Inch.		Inch.
Bismarck, Dak.....	0.88	Brownsville, Tex.....	0.22
Deadwood, Dak.....	0.87	San Diego, Cal.....	0.22
Poplar River, Mont.....	0.85	Galveston, Tex.....	0.24
Fort Sully, Dak.....	0.81	Corpus Christi, Tex.....	0.24
Fort Maginnis, Mont.....	0.80	Los Angeles, Cal.....	0.25
Fort Buford, Dak.....	0.79	Fort Apache, Ariz.....	0.25

AREAS OF HIGH PRESSURE.

Six areas of high pressure were observed within the limits of the region of observation during the month. Five of these areas appeared first on the north Pacific coast, four of which passed to the east of the Rocky Mountains, and three were traced across the continent and disappeared off the New England coast. One area of high pressure moved southward from north of the Maritime Provinces and disappeared to the southeast of Nova Scotia. The general course of movement of these areas was to the eastward while the centre of greatest pressure remained over the continent. In approaching from the north Pacific the direction of movement was apparently to the north of east, and while passing over the Atlantic from the north Atlantic coast the general direction of movement was to the south of east. At no time during the month was the centre of greatest pressure to the south of latitude 40°. The high areas which passed to the east of the Rocky Mountains apparently inclined to the southeastward while approaching the upper Mississippi valley, after which the direction of movement was directly eastward until the centre reached the coast line.

I.—On the morning of the 1st this area of high pressure was apparently approaching from the north Pacific west of Oregon. It remained central near the coast line during the 2d and 3d, moving slowly to the northeast, and on the morning of the 4th had passed to the north of Washington Territory and was central in British Columbia, it having been preceded in that region by the area of low pressure traced as number i. This area of high pressure seems to have reached its highest latitude at this report; after which it moved southeastward, following the general course of the Missouri Valley, and becoming more contracted and more clearly defined; slight areas of low pressure being at that time central over the Lake region and southward over Colorado and New Mexico. The southeasterly movement continued during the 5th, causing the area of low pressure to the southward to disappear, while the pressure generally increased over the eastern slope of the Rocky Mountains. After the centre reached the lower Missouri valley the course of this area changed to the eastward and it passed over the Lake region to the upper Saint Lawrence valley, where it was central on the morning of the 7th. The pressure increased to the southward on the Atlantic coast during the 7th and 8th, while the centre of greatest pressure moved southeast from the upper Saint Lawrence valley over New England to the Atlantic, where it was last observed on the morning of the 9th central off the New Jersey coast.

II.—This area was first observed to the north of the Gulf of Saint Lawrence on the morning of the 12th, when it moved slowly southward, covering the Maritime Provinces and New England during the 3d, the centre appearing to pass southward over Nova Scotia, but the increase of pressure extended over the Atlantic coast as far as the south Atlantic states, preceded by showers and attended by cool northeasterly winds. It disappeared during the 5th, moving to the southeastward over the Atlantic.

III.—This area appeared on the north Pacific coast on the morning of the 8th, the centre apparently being to the north of Washington Territory. It moved directly eastward, extending over the northern Rocky Mountain districts, and by the morning of the 9th the centre of greatest pressure had reached northwestern Dakota; there being a trough of low pressure extending from Arizona northeastward to Upper Canada, separating this area of high pressure from that described as number i, which on the morning of the 9th covered the states on the Atlantic coast. This area of high pressure decreased in energy and passed eastward to the north of the Lake region, and disappeared without causing a marked change in the meteorological conditions within the limits of the United States.

IV.—This area was first observed as central in the Rocky Mountain region, south of Montana, but probably approached to that position from British Columbia. It moved slowly to the south of east over northern Dakota. From this region the

movement of this area was first eastward to a point near, and north of, Lake Superior and afterwards to the southeastward over the Great Lakes during the 12th and 13th, attended by northerly winds and fair weather in the northeastern portion of the United States, and possessing but slight energy, the pressure at the centre having diminished during the passage of this area to the eastward. It was last observed as central in eastern New York on the 14th, after which it moved southeastward in advance of an area of low pressure which on that date was moving eastward over the upper Mississippi valley.

V.—This was one of the three principal areas of high pressure which were observed on the Pacific coast and moved eastward, crossing the continent and disappearing as well-defined areas of high pressure over the Atlantic coast. It appeared off the Oregon coast on the morning of the 20th, moving slightly to the north of east until the centre passed to the east of the Rocky Mountains, when the movement was easterly. After reaching the centre of the continent it remained almost stationary during the 23d, 24th, and 25th, covering northern Minnesota and Manitoba, and causing light frosts in that section on the morning of the 24th. From this region it moved slowly to the southeastward, covering the Great Lakes during the 26th, 27th, 28th, and 29th; after which the movement was apparently to the southeast, and the reports indicated that after reaching the coast line it was reinforced by a second high area from the north Atlantic. At the close of the month this high area was approximately located as central to the east of Nova Scotia.

VI.—This area appears to have approached the coast of Washington Territory from the Pacific on the 30th as a slight area of high pressure, and continued in that region; the pressure increasing in that section on the last day of the month.

AREAS OF LOW PRESSURE.

Eight areas of low pressure were traced over the United States and adjoining territories during the month of August, while two well-defined tropical storms passed along the Atlantic coast, following the general course of the Gulf Stream and causing dangerous gales along the coast from Florida to the Maritime Provinces, although the winds at the coast stations during the passage of these storms were not unusually high, except on the east coast of Florida, yet the change of direction served to locate approximately the progress of the storm.

The storms traced eastward over the continent all passed north of the Ohio Valley and reached the Atlantic coast north of Cape May, N. J. Three areas of low pressure approached the stations from the north of Montana and apparently originated to the westward of the Rocky Mountains. Three were first observed in the central Rocky Mountain region, and two seem to have developed in the Mississippi Valley. Those originating to the north of the United States moved slightly south of east towards the Lake region, and afterwards changed direction to the northeast upon reaching the vicinity of the Saint Lawrence Valley. Of the five low areas first located within the centre of the United States, the general direction of movement was slightly to the north of east; the course becoming more northerly after approaching the Atlantic coast.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed and the average hourly velocity of each:

Areas of low pressure.	First observed.		Last observed.		Average progress in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.....	52 00	115 00	50 00	66 00	24.0
II.....	54 00	113 00	53 00	100 00	30.0
III.....	45 00	107 00	51 00	86 00	27.0
IV.....	40 00	105 00	52 00	99 00	39.0
V.....	54 00	105 00	44 00	60 00	27.0
VI.....	38 00	102 00	39 00	73 00	26.0
VII.....	36 00	92 00	48 00	62 00	31.0
VIII.....	40 00	108 00	33 00	100 00	24.0
	43 00	90 00	41 00	75 00	23.0

Average rate of progress, 31.4 miles per hour.

I.—During the 1st and 2d of the month the pressure was low in the Rocky Mountain region and in Arizona, but on the afternoon of the 2d this area apparently developed north of Montana, immediately in advance of the area of high pressure which was then moving eastward from the Pacific, and extended over the north Pacific coast. The barometer continued low west of the Mississippi and in the Rocky Mountain region, and a secondary depression developed on the eastern slope of the Rocky Mountains and in the upper Mississippi valley, attended by heavy local rains during the 3d and 4th, while the principal depression moved eastward towards the Lake region, where it was central near Lake Superior on the afternoon of the 4th. The area of rain attending this depression extended southward over the Ohio Valley and Tennessee, thence eastward to the Atlantic coast, and accompanied the disturbance as it moved eastward and northeastward over the Saint Lawrence Valley. The winds increased in force after shifting to westerly, and this storm apparently increased in energy after reaching the Atlantic coast, although the barometer was lower at the centre when the storm was first observed north of Montana than it was when last observed. In the lower lake region, Ohio Valley, Tennessee, and at southern Rocky Mountain stations the highest temperatures of the month occurred during the prevalence of this low area.

II.—This disturbance appeared at midnight of the 5th near the region where number i was first observed, and while said disturbance was central in the Saint Lawrence Valley. It remained for twenty-four hours north of Montana and Dakota, when a secondary disturbance developed in the northern Rocky Mountain region, and the principal disturbance apparently passed to the northeast of the stations of observation. On the morning of the 7th this secondary depression extended over the upper Missouri valley, and it moved eastward over Dakota and Minnesota during the 7th and 8th, attended by rains in the northern portions of the districts named. The barometer rose during the easterly movement of this depression, and it disappeared to the northeast of Lake Superior without producing any marked change in the weather conditions east of the Mississippi.

III and IV.—The tri-daily reports received during the 8th and 9th indicate the presence of a barometric depression over the plateau regions, which apparently moved slowly to the eastward and formed the area of low pressure traced as number iii, which was central in northern Colorado on the morning of the 9th. This disturbance extended to the northeast, and moved over Nebraska, Iowa, and Minnesota during the 9th and 10th, developing but slight energy. The weather remained fair and very warm in the southern quadrants, within which maximum temperatures generally ranged near or exceeded 100°. Local storms occurred in the upper lake region and the upper Mississippi valley during the passage of this disturbance, rains generally occurring about the time when the line of lowest pressure passed the stations. During the transit of this low area over Colorado to the northeast, a depression appeared to the north of Montana, moving slowly to the southeastward, and at midnight of the 10th these disturbances apparently united to the north of Lake Superior, forming the area afterwards traced as number iv. The rains attending this disturbance partially relieved the drought sections of the upper lake region, northern Illinois, and northeastern Iowa. The course of disturbance after the union of the two depressions, previously described, was to the southeast over the upper Saint Lawrence valley and New England during the 11th and 12th, attended by heavy local rains as far south as Virginia and the upper Ohio valley. It was central on the north New England coast on the afternoon of the 12th, after which it moved to the northeast over Nova Scotia, and it was last observed as central near Sydney on the morning of the 13th.

V.—This disturbance, although first noted as central in western Kansas, probably originated to the westward of the Rocky Mountains, over the plateau regions, and extended as a feeble disturbance during its passage over the eastern slope of the

Rocky Mountains, attended by local showers, but it became more clearly defined when passing eastward over the Mississippi Valley. Although the depression at the centre of the disturbance was but slightly below the normal, its movement could be traced by the direction of the wind at the stations within the disturbance. The rains were unusually heavy in the upper Ohio valley and along the southern portions of the Lake region. As it approached the middle Atlantic coast, secondary disturbances were formed to the south, which were accompanied by very heavy local rains in North Carolina and Tennessee. The centre passed to the east of the coast line on the New Jersey coast during the night of the 15th, and the succeeding reports from vessels indicate that this storm increased greatly in energy immediately after passing over the Atlantic. Severe gales occurred off Nantucket, Mass., and south of Halifax, N. S., indicating that the course of the storm changed to the north of east.

VI.—The barometer was below the normal at the southern Rocky Mountain stations during the 16th, and this condition resulted in the development of a slight disturbance in northern Texas, which passed to the central Mississippi valley, attended by local rains, on the 16th and 17th. The centre of this disturbance passed directly over the region of drought, and the rains attending it were a great benefit, although the crops had been permanently injured by the long-continued drought. This storm passed directly over the Ohio Valley, middle Atlantic, and New England states, during the 17th and 18th; it increased in energy during its easterly course, the pressure decreasing from 29.80 to 29.60, and below, by midnight of the 18th, when the storm was central near Eastport, Me. Severe southerly gales occurred on the New England coast during the 18th, when the storm was clearly defined and of slight area. This disturbance reached its maximum energy while passing over New England, although the pressure continued to decrease while the centre was passing over the Maritime Provinces. Westerly gales are reported from the upper Saint Lawrence valley on the 19th and strong westerly winds continued on that date on the New England coast.

VII.—At midnight of the 19th an area of low pressure was central in western Colorado, the barometer being generally below the normal at the Rocky Mountain stations. This condition of pressure continued during the 20th, with an apparent easterly movement when the centre of disturbance was over the central eastern slope of the Rocky Mountains. This area of low pressure developed but slight energy, and was apparently forced southward over Texas by the advance of an area of high pressure over the northern Rocky Mountain region; after midnight of the 21st it ceased to exist as a well defined area of low pressure.

VIII.—This storm developed in the upper Mississippi valley in advance of the area of high pressure above referred to, and it was first located central in southern Wisconsin on the morning of the 22d. The rain-area attending this storm covered the greater portions of the United States east of the Mississippi and Missouri valleys. The storm moved eastward over the southern portion of the Lake region to the middle Atlantic coast, where it was last observed as central on the morning of the 23d.

During the passage of this storm over the Lakes, a cyclone appeared to the southeast of Florida and moved along the Atlantic coast, following the general course of Gulf storms, and causing severe gales near the coast from the 22d to 26th. This storm was preceded by a cyclone which moved over approximately the same course from the 19th to the 22d. The tracks of the centres of these disturbances will be found on chart number i. In locating the centres of these disturbances a large number of official reports from regular correspondents, and in addition a number furnished through the courtesy of Commander J. R. Bartlett, Hydrographer, Navy Department (for which the Service desires to acknowledge its indebtedness), were utilized, especially in determining the tracks of the centres of the tropical storms traced on chart number i.